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(11) **CA 506386**

(54) **WATER HEATER**

(54) **CHAUFFE-EAU**

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ABSTRACT:

CLAIMS:

*** Note: Data on abstracts and claims is shown in the official language in which it was submitted.

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Important Notices

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The invention relates to an apparatus by means of which the heating of an under pressure liquid may be attained and, more particularly, this invention relates to an improved heater by means of which water as supplied by the
5 civic or public supply service may be heated.

Water heaters according to this invention are suitable for domestic use as source of hot water for bathrooms, washing and the like, and for industrial use, where a supply of hot water is needed.

10 The primary object of this invention is to provide a simple and reliable apparatus which is not subject to the common objection to which water heaters of conventional type are subject, namely to the danger of explosion or
15 other very serious accidents if some fault or damage in the control or safety devices occurs. According to the current knowledge, water heaters of conventional type comprise substantially a tank in which water under pressure flows, and one or more heating units directly immersed
20 in said water, a set of safety devices being necessarily provided to prevent overpressure if the temperature rises to the boiling point. Moreover, water heaters of conventional type must be constructed so as to safely sustain heavy pressure tests, during which the device works under high pressures, well above regular working conditions, and said
25 necessity considerably increases the cost of the apparatus.

The primary object is attained, according to this invention, substantially by providing a water heater comprising two separate tanks, in one of which water under pressure may flow, and in the other one of which water
30 or other liquid is kept at constant level and in constant communication with the exterior. The two tanks are separated by a wall, or partition, through which heat may be easily

transmitted. In the second tank one or more heating units are immersed, and safety and control devices may also be incorporated therewith if desired.

As a result of the above described arrangement the
5 water under pressure may be heated by the liquid contained in the second tank only, without danger of overheating because said liquid cannot attain a temperature above boiling, said liquid being heated inside an open chamber.

In a preferred embodiment of the invention, one tank
10 is arranged inside the other tank, the inner tank being made of steel, or iron, or copper, or other suitable material through which heat may easily be transmitted.

According to this invention the tank in which the heating units are placed may be supplied with water or other
15 liquid, according to the use and the requirements. In one embodiment of this invention said tank is supplied with water drawn from the first tank through a passage provided between the two tanks, a suitable constant level device being provided for closing said passage as the water in said
20 second tank attains the desired level.

Another object of the invention is a generally improved construction, such as to allow easy assembly of the parts comprising the apparatus, and easy removal of same.

Another object of the invention is the arrangement
25 of the various operating parts of the apparatus allowing the supply of heated, pure and soft water into the tank in which said water is subjected to direct action of the heating unit, or units.

These objects are attained substantially by construct-
30 ing an apparatus comprising an outer larger tank the bottom of which is provided with an opening so dimensioned as to allow introduction of an inner smaller metallic tank, the

latter tank being borne by a plate which provides a water tight cover of said opening; through said plate the various heating units, pipes, control and safety devices may be brought inside the interior of said inner tank, the water
5 contained in which is kept at constant level and directly heated by the heating units, while the space between the outer surface of the inner tank and the inner surface of the outer tank constitutes the chamber in which the water under pressure flows and is heated. The removal of said
10 plate brings out all the several operative units for easy control, maintenance and repair.

With the foregoing and other features and objects in view, the present invention will now be described in further detail with particular reference to the accompanying
15 drawings, wherein:

Fig. 1 diagrammatically represents a simplified embodiment of this invention, the apparatus shown comprising the least number of operative parts needed to actuate invention, said apparatus being shown in vertical sectional
20 view.

Fig. 2 represents in sectional vertical view a preferred embodiment of the invention.

In the drawings the various heating units, control and safety devices are not shown in detail as any of the well
25 known devices adapted to such purposes may be employed.

Referring first to Fig. 1: a water heater according to this invention comprises an outer tank 1 provided with an outer insulating covering 10 and with an inlet passage 7 and an outlet passage 9, the latter being normally closed
30 by a valve, not shown, of any suitable type. Through said inlet passage 7, water or other liquid, which constitutes

thr "heating liquid" may be introduced within said outer tank 1, and kept therein at constant level 5 by a valve 6 provided with a float 8. At least one heating unit 2 is provided within said tank 1 and so arranged to be fully covered by said heating liquid kept at constant level 5. Through the said outlet passage 9 the heating liquid can be drawn from the tank 1 when necessary for repairs, maintenance or cleaning purposes.

The interior of said tank 1 communicates with the exterior through a pipe 3, the inner end 4 of which is placed near the top of said tank and over constant level 5 of the heating liquid. Through said pipe 3 steam may be freely discharged to the interior when boiling of the heating liquid occurs, for example because of inoperativeness of the automatic control devices and, at any rate, when the heating power of heating unit is not properly balanced by the absorption of heat. Through the pipe 3 the heating liquid may be discharged also when its level rises over the regular working level 5, for example because of derangement of the valve 6.

Within said tank 1 a smaller tank 12 is placed, said tank 12 being made of metal or other suitable material through which heat easily may be transmitted from the heating liquid contained in the tank 1 to the water contained in the interior 11 of said smaller tank 12; said water constitutes the "heated water." The circulation of water under pressure inside said tank 12 is obtained through an inlet passage 13 and an outlet passage 14. According to the current practice in water heater construction the inlet passage ends near the bottom of tank 12 and the outlet passage 14 opens near the top of the said tank.

It will be easily understood that the heated water supplied under pressure to the inner tank 12 cannot be heated up to a dangerous temperature because said water is heated by the heating liquid contained in outer tank 1, said liquid in its turn being not allowed to attain a temperature over the boiling temperature, at atmospheric pressure, being contained in a chamber which is in communication with the exterior. In the very worst circumstances, supposing all regular control devices were to fail and the valve were to remain closed owing to some derangement, the heating liquid will slowly be exhausted by boiling but such adverse circumstances will not give rise to accident, because the heat given out by the heating unit cannot reach the inner tank 12, by lack of the transmitting medium.

15 In a most preferred embodiment of this invention, an apparatus substantially comprising, in combination, all above described operative parts may be usefully constructed in the improved form shown in Fig. 2.

This apparatus comprises an outer tank 21, externally coated by an insulating wall 22. Said tank 21 is shaped in the form of an upset pot, the opening of which is closed by a plate 23 tightly connected to the edge of said tank 21 by means of a series of bolts or other suitable means. An annular gasket 24 pressed between the outer portion of said plate 23 and the out-turned flange 25 of tank 21 ensures a water-tight joint. Substantially medially of said plate 23 a large opening is provided, through which opening a smaller metallic tank 26 may be introduced into said tank 21, said tank 26 being in its turn supported by a plate 27 firmly secured to the plate 23 by means of a second series of bolts or other equivalent securing means, a second annular gasket 28 being provided to ensure a tight joint between plates 23 and 27.

The space 29 within the smaller tank 26 constitutes the chamber in which the heating liquid is kept at constant level, and at atmospheric pressure, while the space 30 between the outer surface of the tank 26 and the inner surface of the outer tank 21 constitutes the chamber in which the heated water may circulate under pressure and be heated. This circulation is provided by means of an inlet conduit 31 terminating inside said space 30 near the bottom of same. The mouth 32 of said conduit 31 may be usefully provided with a suitable diffuser for breaking up the surge of cold incoming water, said diffuser being not particularly described or shown because its construction may be made by using current knowledge. The heated water is discharged from space 30 through an outlet pipe 33 the opening 34 of which is placed near the top of tank 21, according to conventional practice.

In the preferred embodiment of this invention shown herein, the heating liquid is constituted by water drawn from the space 30, through a passage 35 provided in the top of the inner tank 26. During regular operation of the apparatus, said passage 35 is kept closed by a valve 36 actuated by a float 37, borne by the same water contained in said chamber 29 when the desired level is attained. The upper portion 38 of said chamber 29 is in constant communication with the exterior through a pipe 39, the opening 40 of which is placed well above the level at which the water contained in tank 26 is kept by the constant level device provided by valve 36 and float 37. Any other suitable constant level device may be used in place of the described one.

The placing of passage 35 in the upper portion of the chamber brings the important advantage that the water drawn from said chamber 30 is supplied from the upper stratum of

water, in which stratum said water is heated so that no material dissolved in water, and particularly calcium, is brought into said inner space 29.

The heating units are located within the space 29.

- 5 These units may be any conventional type, and preferably, they comprise a resistor 42, enclosed in a casing 41, arranged in the lower portion of said space 29 and borne by the plate 27.

- 10 According to current practice, an improved water heater substantially as described and shown may be usefully provided with a suitable automatic control device, namely with a thermostat of any conventional type enclosed into a casing 45 immersed in the heating water contained in the chamber 29. The thermostatic device may be carried by the
15 plate 27.

- Useless consumption of current and damage may be avoided, in the event that the apparatus is started when there is no water in the chamber 29, by providing a suitable safety device, consisting of a fuse 44 made of any known
20 metallic alloy which melts when heated up to a temperature slightly above the boiling temperature of water at atmospheric pressure, said fuse being part of the feeding circuit of the resistor 42 or electrically connected to said feeding circuit by means of a relay. A suitable casing 43
25 is provided for protection of the fuse 44, said casing being immersed in the heating liquid contained in chamber 29 and and borne by plate 27. To provide for clear vision of the combination of parts comprised in the apparatus, the casing 45 of thermostat and the casing 43 of fuse are shown in the
30 drawing well apart from the casing 41 of heating unit.
- In the practical construction of the apparatus, it is preferable that the casings be placed near one another, so that

heat radiated by the heating unit may quickly warm up both the control device and the safety device, even if no water is contained in chamber 29. Of course, the temperature at which the thermostatic device self-acts is
5 well below the temperature at which the fuse 44 melts, so that said fuse remains intact but when the thermostatic device is damaged or inoperative, the fuse will function to prevent damage.

The arrangement of the automatic control device and
10 of said safety device in the chamber in which heating water is contained gives important advantages, because said devices arranged as described are sensitive to the temperature of the liquid contained in the apparatus and which attains the higher temperature; it will be easily under-
15 stood that the heated water cannot be heated to an higher temperature than that of the heating water as the said heated water is brought to its heated state by the said water heater.

The described arrangement of the heating unit, of the automatic control device and of the safety device on the
20 plate 27, the lower surface of which is external, gives other important advantages also, because any one of said units and devices may be easily removed for control, maintenance and repair purposes, when needed. Other advantages are obtained by the fact that the plate 27 is
25 the bearing member of the inner tank 26, in the upper part of which the constant level device is arranged, because the removal of said plate 27 from plate 23 brings about the removal of all operative parts and provides a large opening in the wall of outer tank 21, allowing access to the
30 interior for cleaning, control and maintenance purposes which is often necessary when the apparatus is supplied with "hard" or impure water.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. An apparatus for heating a liquid under pressure comprising, in combination, a larger tank, a smaller tank placed inside said larger tank, said smaller tank having a wall consisting of a heat-conducting material, means for introducing a liquid into one of said tanks, means for keeping said liquid at a constant level inside said one of said tanks so as to leave the upper part of said one of said tanks free of liquid, means for establishing a permanent communication between the upper part of said one of said tanks and the atmosphere so as to keep the liquid therein at atmospheric pressure, means for heating said liquid kept at constant level and at atmospheric pressure in said one of said tanks, and means for circulating the liquid under pressure in the other of said tanks, said wall being at both sides thereof in heat exchange with said liquids contained in said tanks so as to form a heat-exchanging element between said liquids.

2. An apparatus for heating a liquid under pressure comprising, in combination, a first larger tank, a second smaller tank placed inside said first tank, said second tank being made of a material through which heat may be easily transmitted, means for actuating a circulation of a liquid under pressure into said second smaller tank, means for introducing a liquid into the space confined between said two tanks, means for keeping said liquid at constant level within said space, a communication between the atmosphere and the upper portion of said space and means for heating the liquid contained at constant level and at atmospheric pressure within said space.

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comprising, in combination, a first larger tank, a second smaller tank placed inside said first tank, said second tank being made of a material through which heat may be easily transmitted, means for actuating a circulation of a liquid under pressure into the space confined between said two tanks, means for introducing a liquid into said second smaller tank, means for keeping said liquid at constant level within said second tank, a communication between the atmosphere and the upper portion of said second tank, and means for heating the liquid contained at constant level and at atmospheric pressure in said second tank.

4. A water heater comprising, in combination, a first closed chamber provided with an inlet opening and with an outlet opening, through which openings water under pressure may fill said chamber and circulate therethrough, a second chamber separated from said first chamber by a metallic wall, a communication between said chambers, means being provided for closing said communication as water drawn from said first chamber attains a predetermined level within said second chamber, a passage one end of which is open to the atmosphere and the other end of which is open within said second chamber above said predetermined level, and means for heating the water kept at said predetermined level and at atmospheric pressure in said second chamber.

5. A water heater comprising, in combination, a larger tank, a smaller tank placed inside said larger tank, said smaller tank being made of a material through which heat may be easily transmitted, means for actuating

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a circulation of water under pressure into one of said tanks, a communication between said two tanks through which communication water may be drawn inside the other one of said tanks, a constant level self-acting valve closing said communication as water drawn inside said other tanks attains a predetermined level, a communication between the upper portion of said other tank and the atmosphere, and means for heating the water contained at constant level and at atmospheric pressure inside said other tank.

6. A water heater comprising, in combination, a first larger tank, a second smaller tank placed inside said first tank, said second tank being made of a material through which heat may be easily transmitted, means for actuating a circulation of water under pressure into the chamber comprised between said two tanks, a communication between said chamber and the interior of said second smaller tank through which communication water may be drawn from said chamber into said second tank, a constant level self-acting valve closing said communication as said drawn water attains a predetermined level within said second tank, a communication between the atmosphere and the portion above said level in the interior of said second tank, and means for heating the water kept at constant level and at atmospheric pressure within said second tank..

7. In a water heater as claimed in claim ⁶~~8~~, a constant level valve comprising a valve abutting on a seat provided in the passage through which the first tank communicates with the second tank, and a float borne by the levelled

liquid inside the second tank and acting on said valve.

8. In a water heater as claimed in claim 6, an insulating coating covering the outer larger tank.

9. In a water heater comprising two chambers, in one of which water circulating under pressure is heated by transmission through the wall dividing said chambers by water contained at constant level and at atmospheric pressure in the other of said chambers and subject to direct action of heating units, the provision of a passage between said two chambers, so that between said passage water may be drawn from the first of said chambers into the other one, and the provision of a constant level valve for closing said passage as the drawn water attains said level in said other chamber.

10. In a water heater comprising two chambers in one of which water circulating under pressure is heated by transmission through the wall dividing said chambers by water contained at constant level and at atmospheric pressure in the other one of said chambers and subject to direct action of heating units, the provision of a passage between said chambers and provided with a constant level valve for closing said passage as the water drawn from said first chamber to said second chamber attains a predetermined level inside said second chamber, and the arrangement of said passage in the upper portion of said chambers.

11. In a water heater comprising a larger tank and a smaller tank placed inside said larger tank, heating units placed inside said smaller tank for heating water kept at constant level and at atmospheric pressure inside said

smaller tank, and means for actuating a circulation of water under pressure in the space confined between said two tanks, in which space said water is heated through the wall of said smaller tank by the water contained in the latter and subject to direct action of said heating units, the provision of a passage through said wall, said passage being provided with a constant level valve for closing said passage as water drawn through said passage into said smaller tank attains a predetermined level, and the arrangement of said passage near the top of said inner tank.

12. A water heater comprising, in combination, an outer tank provided with an insulating coating, an inner metallic tank enclosed in said outer tank and dividing the interior of the latter in two chambers, the chamber comprising between the outer surface of the inner tank and the inner surface of the outer tank being provided with an inlet passage and with an outlet passage through which passages a circulation of water under pressure may be actuated into said chamber, a passage provided through the wall of said inner tank and positioned near the top of same, a valve inside said passage for closing the same, a float connected to said valve and placed inside said inner tank, said float being arranged for operating said valve in closed position as the water inside said inner tank reaches a level, a heating unit placed inside said inner tank below said level, an open pipe crossing the wall of the inner tank, one end of said pipe being placed in the interior of said inner tank above said level and the other end being externally placed about the apparatus.

13. A water heater comprising, in combination, an outer tank provided with an insulating coating, an inner metallic tank enclosed in said outer tank and dividing the interior of the latter in two chambers, the chamber comprised between the outer surface of said inner tank and the inner surface of said outer tank being provided with an inlet passage and with an outlet passage through which passages a circulation of water under pressure may be actuated into said chamber, a passage provided through the wall of said inner tank and positioned near the top of the same, a valve inside said passage for closing the same, a float connected to said valve and placed inside said inner chamber, said float being arranged for operating said valve in closing position as the water inside said inner tank reaches a predetermined level, a communication between the upper portion of the chamber comprised inside said inner tank and the atmosphere, an electric heating unit placed inside said inner tank and below said level, a thermostatic device placed inside said inner tank and below said level, said thermostatic device being electrically connected to the feeding circuit of said heating unit, and a fuse placed inside said inner tank and near said heating unit, said fuse being part of an electric circuit connected to the said feeding circuit.

14. In a water heater comprising two tanks one of which is placed inside the other and forming two chambers, in one of which water under pressure may circulate and be heated by heated water contained at constant level and at atmospheric pressure in the second chamber, an outer assembly comprising the outer tank, the bottom of which is

provided with an opening so dimensioned that the inner tank may be introduced therethrough, and an inner assembly comprising the inner tank the bottom of which is connected to a plate, said plate being removably connected to the bottom of said outer tank and forming a closure for the opening of the latter.

15. In a water heater comprising an outer tank and an inner tank, means for actuating a circulation of water under pressure inside the chamber comprised between said two tanks, means for keeping a liquid at constant level and at atmospheric pressure inside the interior of said inner tank, heating units and heating control devices placed inside said inner tank, an outer assembly comprising the outer tank the bottom of which is provided with an opening so dimensioned that the inner tank may be introduced therethrough, and an inner assembly comprising the inner tank, a plate bearing said inner tank and forming an out-turned flange around the bottom of said tank, and securing means for tight connection of said flange to the edge of said opening, said heating units and control devices being introduced through and borne by said plate.

16. A water heater comprising, in combination, an outer tank in shape of an inverted pot and coated with an insulating coating, the bottom of said tank being closed by a plate secured to an out-turned flange provided on the edge of said tank, a row of bolts as securing means between the contour of said plate and said out-turned flange, an annular gasket between said contour and said flange, an opening about the centre of said plate, a second plate covering said opening and removably connected to said first plate

by means of a second round of bolts, a second annular gasket between said two plates, a metallic tank borne by said second plate and arranged through said opening and into said outer tank, an inlet pipe through said first plate, the end of said pipe being placed near the bottom of the chamber confined by the inner surface of the outer tank and by the outer surface of said inner metallic tank, an outlet pipe through said first plate, the intake opening of said outlet pipe being placed near the top of said chamber, an inner tank placed inside said outer tank and introduced therein through said opening provided in said bottom plate, said inner tank being borne by the said removable second plate, a pipe going through said second plate, one end of said pipe being placed in the chamber enclosed in said inner tank and near the top of same, a communication going through the top of said inner tank, a valve arranged along said communication and operated by a float, said float being placed inside said inner tank and so positioned that the floating of the same on the liquid drawn into said inner tank through said communication, as said liquid attains a predetermined level brings said valve in closed position, a heating unit comprising a resistor and borne by said second plate and placed inside said inner tank, a thermostatic device borne by said second plate and placed inside said inner tank, said thermostatic device being electrically connected to the feeding circuit of the resistor for control of the current supply to said resistor, a fuse borne by said second plate and placed inside said second tank, said fuse being part of a circuit connected to the feeding circuit of the resistor

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for cutting off the current supply to said resistor as said fuse melts.

17. An apparatus for heating a liquid under pressure, comprising, in combination, a first tank; a second tank located within said first tank, said second tank being in direct heat exchange with said first tank; means for supplying a liquid to one of said tanks; means for keeping said liquid at a constant level within said one of said tanks so as to leave the upper part thereof free of liquid; means for establishing a permanent communication between said upper part of said one of said tanks and the atmosphere so as to keep the liquid therein at atmospheric pressure; means for heating said liquid in said one of said tanks; and means for circulating the liquid under pressure in the other of said tanks, said liquid under pressure being heated by the heat exchange between said tanks.

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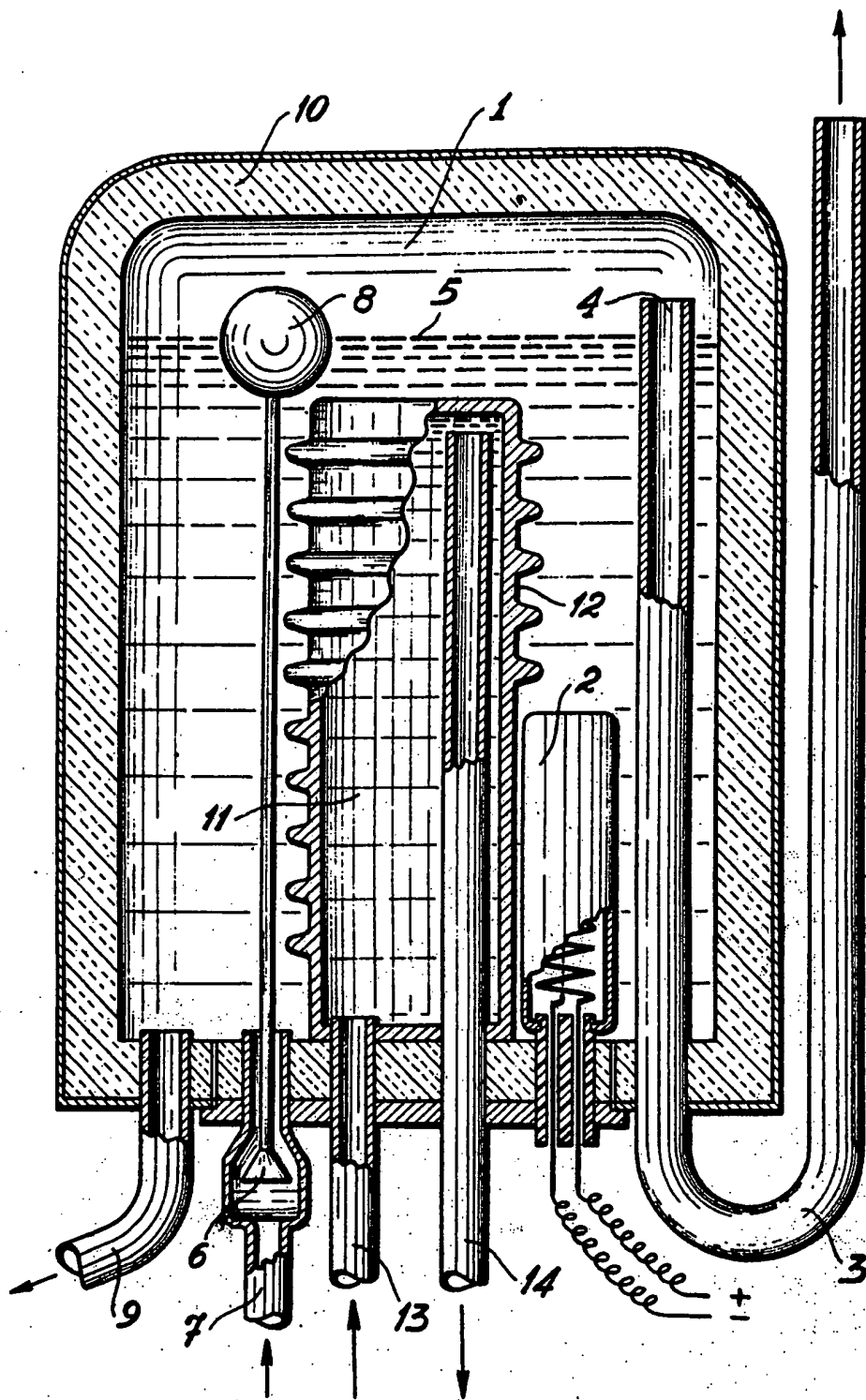


Fig. 1

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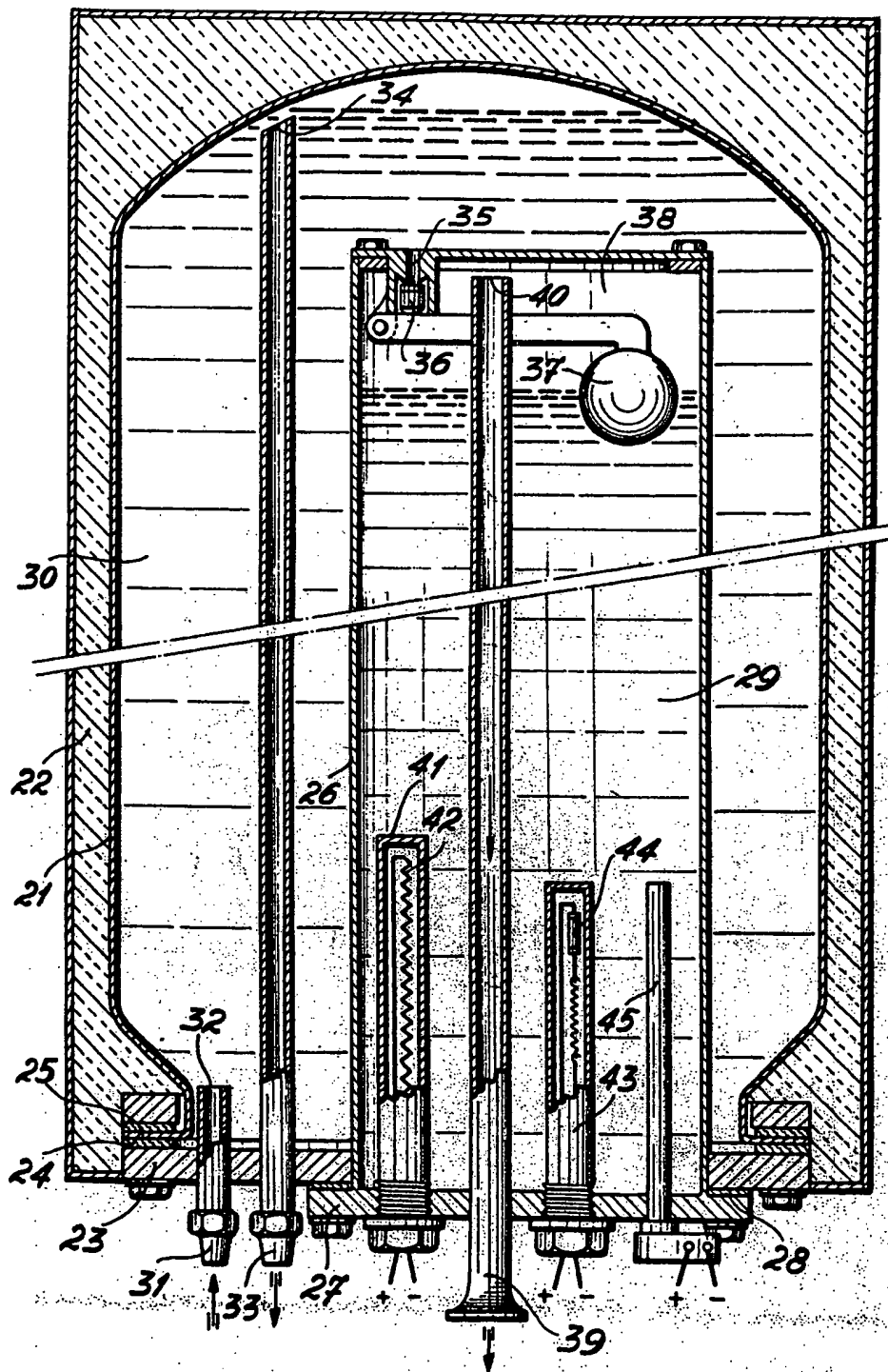


Fig. 2

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